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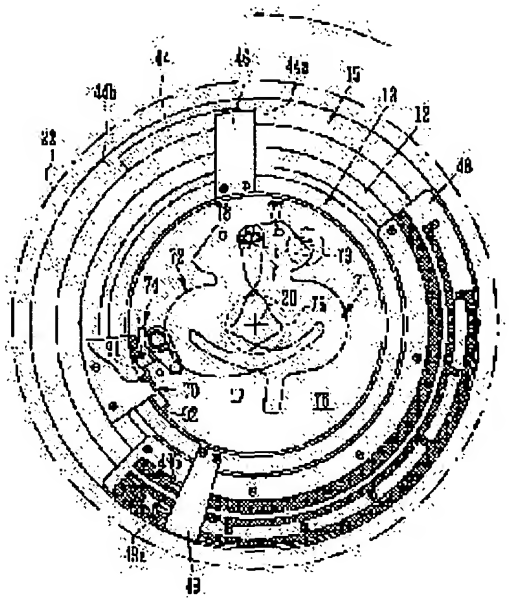
(54) ZOOM LENS

(57)Abstract:
PROBLEM TO BE SOLVED: To make the diameter of the lens barrel of a zoom lens small.
SOLUTION: A notched part 92 is provided at one part of the outer periphery of a shutter block. The part to be worked 91 of a regulating lever being a 1st regulating member for regulating the maximum diameter of opening of shutter blades 71 and 72 is exposed to the inside of the notched part 92. A cam member 70 gets into the inside of the notched part 92. The member 70 is provided in a straight advance guide barrel 12. The barrel 12 moves in the direction of an optical axis 20 with respect to a front-group supporting barrel holding the shutter block at the time of variable power. A cam surface pressuring the part 91 in a nearly circumferential direction centering the optical axis 20 is formed on the member 70. The cam surface regulates the maximum diameter of opening of the blades 71 and 72 in accordance with the variable power by pressuring the part 91 by utilizing relative displacement along in the direction of the optical axis 20 of the front-group supporting barrel and the barrel 12.



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* NOTICES *

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2. **** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] The zoom lens characterized by providing the following. 1st specification-part material which regulates the diameter of the maximum opening of the shutter wing which it is exposed of the notching section formed in the periphery of the shutter block which built in the shutter mechanism, and was prepared in the aforementioned shutter block side. The variable power cylinder displaced according to variable power operation of a lens. the 2nd specification-part material which is prepared in this variable power cylinder side, and acts on the specification-part material of the above 1st according to the variable power of this variable power cylinder -- having -- this -- the open opening regulation characterized by making it the 2nd specification-part material enter into the aforementioned notching section
[Claim 2] A zoom lens equipped with the open opening regulation according to claim 1 whose shutter block which is the zoom lens which consists of 2 of the 1st lens group and the 2nd lens group groups, and built in the shutter mechanism is characterized by being fixed to either the lens group of the above 1st, or the 2nd lens group.

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[Claim 2] A zoom lens equipped with the open opening regulation according to claim 1 whose shutter block which is the zoom lens which consists of 2 of the 1st lens group and the 2nd lens group groups, and built in the shutter mechanism is characterized by being fixed to either the lens group of the above 1st, or the 2nd lens group.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to a zoom lens equipped with the open opening regulation which changes the diameter of the maximum opening of a shutter wing according to the focal distance of a taking lens.
[0002]
[Description of the Prior Art] According to a focal distance, it changes so that it may be [in / a tele edge / it is / in / a wide edge / on the value to which the luminosity of a zoom lens quantified the maximum aperture, and] more bright and] more dark and may become gradually dark further towards the tele edge from a wide edge in between these. On the other hand, the maximum aperture needs to make the diameter of opening small towards a wide edge, in order for the luminosity of a lens to change to each focal distance. Then, the drawing opening regulation equipment of the zoom lens to which coordinate with the attitude of a zoom lens lens-barrel, and it was made to change drawing opening at the time of opening by the side of a shutter is proposed by JP,3-107132,A etc.
[0003] To the 2nd lens-barrel displaced to the 1st lens-barrel which extracted at the time of variable power and had the program shutter of combination with equipment given [above-mentioned] in an official report Establish the cam side for regulating the open value of a drawing value, make the drive lever which extracts to this cam side and drives the shutter wing of the program shutter of combination engaged, and with the variation rate of the 2nd lens-barrel to the 1st lens-barrel at the time of variable power By regulating the rotation range of the aforementioned drive lever, the diameter of the maximum opening of the shutter wing according to the focal distance is regulated.
[0004]
[Problem(s) to be Solved by the Invention] However, it is necessary to establish the cam side of equipment given [aforementioned] in an official report in a shutter block and the position in which it does not interfere, therefore it is arranged on the outside of a shutter block. Therefore, it is necessary to also make a drive lever project towards the direction of outside (direction which separates from an optical axis) from the periphery of a shutter block. For this reason, there was a fault that the size of the lens-barrel itself enlarged only the part of the arrangement space of a drive lever and a cam side in the direction of a path centering on an optical axis, as a result the zoom lens itself was enlarged.
[0005] this invention is for solving the above-mentioned trouble, and aims at offering the zoom lens equipped with the open opening regulation which can make the lens-barrel itself small.
[0006]
[Means for Solving the Problem] In order to attain the above-mentioned purpose with the zoom lens of this invention The 1st specification-part material which regulates the diameter of the maximum opening of the shutter wing which it is exposed of the notching section formed in the periphery of the shutter block which built in the shutter mechanism, and was prepared in the aforementioned shutter block side, the variable power cylinder displaced according to variable power operation of a lens, and the 2nd specification-part material which is prepared in this variable power cylinder side, and acts on the specification-part material of the above 1st according to the variable power of this variable power cylinder -- having -- this -- it is made for the 2nd specification-part material to enter into the aforementioned notching section
[0007] Moreover, with zoom lens equipment according to claim 2, it is the zoom lens which consists of 2 of the 1st lens group and the 2nd lens group groups, and the shutter block which built in the shutter mechanism is fixed to either the lens group of the above 1st, or the 2nd lens group.
[0008]
[Embodiments of the Invention] The zoom lens 10 equipped with open opening regulation of this invention As shown in drawing 1 or drawing 4 , it is 2 group zoom lens which consisted of the pre-group lens support cylinder 11, the rectilinear-propagation guide cylinder 12, the cam cylinder 13 for back groups, a back group support cylinder 14, a tumbling barrel 15, and fixed cylinder 16 grade. By rotating a tumbling barrel 15 using rotation of the single motor 17 Move the pre-group lens 18 and the back group lens 19 in the direction of an optical axis 20, changing a mutual distance lens between groups, and variable power is performed. It focuses by moving the pre-group lens 18 and the back group lens 19 in the direction of an optical axis 20 in the state of the variable power, after that, so that it may become lens between groups [from the change at the time of the aforementioned variable power / different].
[0009] The gear section 22 projected and formed in the gap of the male helicoid screw 21 and its male helicoid screw at the periphery is formed in the tumbling barrel 15. The drive of a motor 17 is transmitted to the gear section 22 through the cylinder gear 23. The female helicoid screw 25 formed in the inner circumference of the fixed cylinder 16 screws in the male helicoid screw 21. A tumbling barrel 15 moves in the direction of an optical axis 20, rotating to the fixed cylinder 16 according to a lead with the male helicoid screw 21 and the female helicoid screw 25. The female helicoid screw 26 is formed in the inside of a tumbling barrel 15. The male helicoid screw 27 formed in the periphery of the pre-group support cylinder 11 screws in the female helicoid screw 26.
[0010] The pre-group lens 18 and the shutter style 28 are being fixed to the pre-group support cylinder 11 sequentially from a body

side. The rectilinear-propagation guide slot 29 parallel to an optical axis 20 is formed in the inner circumference of the pre-group support cylinder 11. The 1st guide height 30 prepared in the periphery front end side of the rectilinear-propagation guide cylinder 12 engages with the rectilinear-propagation guide slot 29. The pre-group support cylinder 11 carries out rectilinear-propagation movement in the direction of an optical axis 20 to a tumbling barrel 15 according to the lead of the helicoid screws 26 and 27 by operation of the rotation stop of the rectilinear-propagation guide cylinder 12 by rotation of a tumbling barrel 15.
[0011] The 2nd guide salient 32 is formed in the rectilinear-propagation guide cylinder 12 at the periphery back end side. The 2nd guide salient 32 engages with the circular sulcus 33 prepared in the inner circumference of a tumbling barrel 15 along with the hand of cut centering on an optical axis 20 free [rotation]. The rectilinear-propagation guide cylinder 12 moves in the direction of an optical axis 20 together with a tumbling barrel 15, where a rotation stop is carried out inside a tumbling barrel 15.
[0012] The flange 35 is formed in the periphery back end at the cam cylinder 13 for back groups. A flange 35 engages with the slot 36 annularly established in the inner circumference of the rectilinear-propagation guide cylinder 12 along with the hand of cut centering on an optical axis 20 free [rotation]. The cam cylinder 13 for back groups is supported by the rectilinear-propagation guide cylinder 12 free [rotation]. The cam opening 38 which had a cam side in the cam cylinder 13 for back groups is formed. The cam follower 39 prepared in the back group support cylinder 14 engages with the cam opening 38. These cam followers 39 engage with the rectilinear-propagation guide opening mouth 40 prepared in the rectilinear-propagation guide cylinder 12 in parallel with an optical axis 20 through the cam opening 38. These cam opening 38, the cam follower 39, and the rectilinear-propagation guide opening mouth 40 are formed in the trichotomy position of the hand of cut centering on an optical axis 20, respectively. In addition, the sign 41 of drawing 2 or drawing 4 is a film plane, and a sign 42 is a frame front cover.
[0013] The notching section 44 is formed in the back end side 43 of a tumbling barrel 15 at a part of hand of cut centering on an optical axis 20. As shown in drawing 5 in detail, the bending nose of cam of the arm 46 of the shape of L character prepared in the back end side 45 of the cam cylinder 13 for back groups is engaging with the notching section 44. The arm 46 is engaging with the hoop direction centering on an optical axis 20 with play inside the notching section 44. The coordinated section in which the play of the notching section 44 and an arm 46 is the idling region of the cam cylinder 13 for back groups, and the notching section 44 and the arm 46 had an idling region is constituted. At the time of variable power, a motor 17 rotates a tumbling barrel 15 and rotates the cam cylinder 13 for back groups across an idling region further. At the time of a focus, a motor 17 rotates a tumbling barrel 15 within idling. The direction of an arrow shown in drawing 5 shows the direction which a tumbling barrel 15 rotates, when a motor 17 is driven in the direction of a tele edge.
[0014] The cam cylinder 13 for back groups is that an arm 46 is pushed with either of two walls 44a and 44b which met the hand of cut centering on an optical axis 20 among the notching sections 44, and the turning effort of a tumbling barrel 15 is transmitted and it rotates to the rectilinear-propagation guide cylinder 12. In drawing 5 , the tele direction rotation transfer wall and reverse side is [wall 44a which transmits the rotation to the direction of a tele edge of a tumbling barrel 15 to the cam cylinder 13 for back groups] wide direction rotation transfer wall 44b. The back group lens 19 is supported by the back group support cylinder 14.
[0015] Since the cam cylinder 13 for back groups rotates in the same direction as a tumbling barrel 15 with a tumbling barrel 15 at the time of variable power, the pre-group lens 18 moves in the direction of an optical axis 20 by composition with the variation rate of a tumbling barrel 15, and the variation rate of the pre-group support cylinder 11, and the back group lens 19 moves in the direction of an optical axis 20 by composition with the variation rate of a tumbling barrel 15, and the variation rate of the cam of the cam opening 38. Since the cam cylinder 13 for back groups does not rotate at the time of a focus, the pre-group lens 18 moves in the direction of an optical axis 20 by composition with the variation rate of a tumbling barrel 15, and the variation rate of the pre-group support cylinder 11, and the back group lens 19 moves in the direction of an optical axis 20 with the variation rate of a tumbling barrel 15.
[0016] the cam which is the 2nd specification-part material at the rectilinear-propagation guide cylinder 12 -- the member 70 is attached in the inside This rectilinear-propagation guide cylinder 12 moves in the direction of an optical axis 13 together with a tumbling barrel 15 at the time of variable power. a cam -- a member 70 moves in the notching section 92 formed in the periphery of the shutter block 28 by the attitude of the rectilinear-propagation guide cylinder 12
[0017] As shown in drawing 6 , the shutter style built in the shutter block 28 consists of two shutter wings 71 and 72, a MUBINGU magnet type motor 73, and open opening regulation mechanism 74 grade, and these are attached in the shutter cope plate 76 in which the shutter opening 75 was formed. If it is fixed to the field of one side of the shutter cope plate 76 and the MUBINGU magnet type motor 73 is energized in a coil, it will rotate only a predetermined angle to positive and an opposite direction according to the energization direction. The rotation shafts 77 and 78 supported free [rotation of the shutter wings 71 and 72] are formed in the field of the other side of the shutter cope plate 76.
[0018] The end of the drive lever 79 is being fixed to the output shaft of a motor 73. The drive pin 80 is formed in the other end of the drive lever 79. the engagement which formed the drive pin 80 in each shutter wings 71 and 72 through the long hole 81 of the shutter cope plate 76 -- it engages with holes 82 and 83 By movement of the drive pin 80, the shutter wings 71 and 72 cross in the front face of the shutter opening 75, and it closes and they rotate between the positions and the open position which all exposed the shutter opening 75 for which the shutter opening 75 was closed. The spring 84 is attached in the drive lever 79. A spring 84 energizes the drive lever 79 towards the direction where the shutter wings 71 and 72 expose the shutter opening 75. The closing position of the shutter wings 71 and 72 has regulated the drive pin 80 by pressing against the end of the long hole 81 of the shutter cope plate 76.
[0019] the regulation lever 87 which the open opening regulation mechanism 74 is a mechanism which regulates the diameter of the maximum opening of the shutter wings 71 and 72, and are a part of profile 86 of the shutter wing 72, and its 1st specification-part material which contacts 86 in part, and the aforementioned cam which is the 2nd specification-part material -- it consists of cam sides 88 established in the member 70 The regulation lever 87 is arranged on rotation tracing of one shutter wing 72, and is attached in the shaft 89 prepared in the shutter cope plate 76 free [rotation]. The regulation pin 90 is formed in the other end, and the acted section 91 is formed in the end at one again at the regulation lever 87, respectively. the cam side 88 -- a cam -- it is formed in the edge of one side of cam opening 70a prepared in the member 70
[0020] The regulation pin 90 regulates the open aperture of the shutter wings 71 and 72 in contact with a part of profile appearance 86

of the shutter wing 72. The acted section 91 is exposed in the notching section 92 which cut and lacked a part of periphery of the shutter block 28. The regulation lever 87 is energized towards the direction where the acted section 91 contacts the cam side 88 with a spring 93.

[0021] a cam -- a member 70 is the inside of the back group cam cylinder 13 in a body [which met in the direction of an optical axis 20], and image formation side side, and it is supported by the rectilinear-propagation guide cylinder 12 so that the interior of the notching section 92 may be entered As for the acted section 91, engagement to the cam side 88 is continued from the collapsing position of a zoom lens 10 before a tele position.

[0022] As shown in drawing 7 , the cam side 88 is formed in the edge of one side which met in the direction of the optical axis 20 of cam opening 70a, and has a variation rate in the hand of cut centering on an optical axis 20. This variation rate is the variation rate which lessens the amount of press gradually to the acted section 91 with the relative variation rate which met in the direction of the optical axis 20 of the rectilinear-propagation guide cylinder 12 and the pre-group support cylinder 11 towards the tele edge from the wide edge. Thereby, the regulation lever 87 enlarges gradually the diameter of the maximum opening of the shutter wings 71 and 72 by the variable power turned to the tele edge from the wide edge. With this operation gestalt, as shown in drawing 8 , it is considering as the cam side 88 to which the diameter of the maximum opening of the shutter wings 71 and 72 is changed from the wide edge of a zoom lens 10 in the region to a specific variable power position position according to a variable power position.

[0023] The shield 95 (refer to drawing 6) is formed in one shutter wing 71. The shield 95 constitutes the mechanism in which shutter opening-and-closing time is detected with the photoelectrical sensor (photograph reflector) 96. The photoelectrical sensor 96 is arranged in the position where a shield 95 crosses the own optical path of a sensor just before the shutter wings 71 and 72 form opening aperture in the front face of the shutter opening 75.

[0024] moreover, it was shown also in drawing 6 -- as -- the back end side of the rectilinear-propagation guide cylinder 12 -- a conductor pattern -- the member 48 is attached The sliding child 49 is attached in the back end side 45 at the cam cylinder 13 for back groups. the sliding child 49 -- a conductor pattern -- it has two brushes 49a and 49b which slide on a member 48 it is shown in drawing 9 -- as -- a conductor pattern -- the pattern 50 for a ground, the 1st pattern 51, the 2nd pattern 52, and the pattern 53 for collapsing positions are formed in the member 48 Brushes 49a and 49b are connected electrically. It connects with the ground, and the pattern 50 for a ground is formed in band-like along the tracing top on which brush 49b slides, when the cam cylinder 13 for back groups rotates according to the variable power between a collapsing position and a tele edge.

[0025] To the 1st pattern 51 and the 2nd pattern 52 On the locus on which brush 49a slides when predetermined voltage is applied from the signal-detection section 55 and the cam cylinder 13 for back groups rotates according to the variable power between a wide edge and a tele edge after the signal section 56 for two or more variable power halt positions responds to a variable power position -- rotation position Z1- of the cam cylinder 13 for groups -- it is arranged for every Z8 When these signal sections 56 make No. 1 the signal section 56 prepared in the rotation position of the cam cylinder 13 for back groups at the time of the wide edge Z1, the even-numbered signal section 56 is formed in the 1st pattern 51, and the odd-numbered signal section 56 is formed in the 2nd pattern 52. With this operation form, the position of Z8 shown in drawing 9 turns into a rotation position of the cam cylinder 13 for back groups at the time of a tele edge.

[0026] The pattern 53 for collapsing positions by the side which approached the hand of cut of the cam cylinder 13 for back groups turned to a wide edge rather than the signal section 56 which itself is making the signal section and was prepared in the rotation position of the cam cylinder 13 for back groups at the time of the wide edge Z1 And it is arranged on the sliding locus of brush 49a, and by the pull-up of the constant voltage from the signal-detection section 55, when the rotation position of the cam cylinder 13 for back groups turns into a position according to the collapsing position, brush 49a contacts and the signal of a low is outputted to the signal-detection section 55.

[0027] The signal-detection section 55 inputs the binary signal corresponding to the existence of the signal sections 53 and 56 of the 1st pattern 51, the 2nd pattern 52, and the pattern 53 for collapsing positions into a controller 60. A binary signal is with the signal of "1" (high level) inputted when signal section nothing, i.e., brush 49a, does not touch the signal sections 53 and 56, and the signal of "0" (low) obtained when 49with the signal section (i.e., brush) a contacts the signal sections 53 and 56. The signal which can acquire hereafter the signal acquired from the 1st pattern 51 from an output signal A and the 2nd pattern 52 is made into an output signal B, the signal acquired from the signal section 53 for collapsing positions is further made into an output signal Hp, the signal which changes from a high-level signal to a low level signal is fallen, it starts and a signal and reverse are explained as a signal.

[0028] The motor 17 for variable power is connected to the controller 60 through the driver 61. The rotary encoder 62 is formed in the output shaft of a motor 17. A rotary encoder 62 detects the angle of rotation of a motor 17, and feeds it back to a controller 60. A controller 60 reads the angle of rotation of a motor 17, and controls a drive halt of the motor in a focus drive etc.

[0029] A controller 60 answers operation of the zoom button prepared in the variable power control unit 63, and makes a motor 17 drive. The zoom button consists of wide side zoom buttons for carrying out adjustable to the call side zoom button for turning a focal distance to a tele edge and carrying out adjustable continuously towards a wide side.

[0030] The counter 97, ROM64, and the RAM65 grade are connected to the controller 60. A counter 97 counts the opening-and-closing time of the SHAYYA wings 71 and 72 based on the signal acquired from the photoelectrical sensor 96. The program for controlling the opening-and-closing time of the shutter wings 71 and 72 according to the combination of a variable power position and photographic subject brightness, the movement magnitude of the pre-group lens 18 according to the combination of a variable power position and photographic subject distance, and a camera etc. is memorized by ROM64. RAM65 is a thing in order to memorize temporarily values, such as opening-and-closing time of the photographic subject brightness obtained from the photographic subject distance acquired from the ranging mechanism 69, or the photometry mechanism 68, and the shutter wings 71 and 72 read from ROM64.

[0031] The direction drive of a tele edge which controls the drive of the motor 17 for variable power in a program according to variable power operation, And the program for the direction drive of a wide edge, the program for a focus drive which drives zoom lens equipment 10 from a variable power position after shutter release in the focus position according to photographic subject distance,

When it detects whether the rotation position of the program for a standby drive and the cam cylinder 13 for back groups which returns zoom lens equipment 10 to a variable power position from a focus position shifted and it is shifted after the completion of exposure, there is a program for error processing returned to the original variable power position.
[0032] A controller 60 is "Z1 (wide position), and Z2, Z3 and Z4 about the variable power position at the time, whenever it detects in order the output signal A obtained at the time of variable power, and the falling signal of an output signal B... It specifies any of Z8 (tele position)" they are. At the time of the variable power turned to a wide edge from a tele edge, a variable power position can be pinpointed by the difference in the hand of cut of a motor 17. The pinpointed variable power position is rewritten and memorized to RAM65 each time.
[0033] The program for the direction drive of a tele edge and the direction drive of a wide edge consists of two flows from which drive control of a motor 17 differs, when the output signal by which the signal section 56 corresponding to the variable power position in front of it was obtained from the signal section corresponding to the variable power position the eventh or odd-numbered [namely,] in front of it after the completion of variable power operation judges whether it is an output signal A.
[0034] The program for a focus drive also consists of two flows from which drive control of a motor 17 differs, when the signal section 56 corresponding to the variable power position at the time judges whether an output signal A is obtained from the eventh or odd-numbered [namely,] signal section.
[0035] Since brush 49a will be in the state where it separated from the signal section 56 of the 1st pattern 51 or the 2nd pattern 52, after a focus in the program for a standby drive, It is the control which returns this even to the signal section 56 corresponding to the variable power position at the time. When the output signal by which the signal section 56 corresponding to the original variable power position is obtained from the eventh or odd-numbered [namely,] signal section 56 judges whether it is an output signal A, it consists of two flows from which drive control of a motor 17 differs.
[0036] The program for error processing is performed for every fixed time in the standby state where the operation of variable power, a focus, exposure, film feed, etc. is not performed. Brush 49a will be in the state where it contacted for any of the signal sections 56 being, waiting. However, the cam cylinder 13 for back groups by which drive transfer is carried out through an idling region has a possibility that a rotation position may shift according to the disturbance force of joining a lens-barrel.
[0037] By the program for error processing, it judges whether the rotation position of the cam cylinder 13 for back groups has shifted, and when having shifted, the drive of a motor 17 is controlled by reading the binary signal of the output signal A inputted at the time, or an output signal B to return the cam cylinder 13 for back groups to the rotation position corresponding to the original variable power position. This control consists of two flows from which drive control of a motor 17 differs [the output signal by which the signal section 56 corresponding to the original variable power position is obtained from the eventh or odd-numbered / namely, / signal section 56] by whether it is an output signal A.
[0038] A controller 60 controls the drive of a motor 17 so that ON of an electric power switch 66 is answered and zoom lens equipment 10 carries out variable power to a wide edge from a collapsing position. This control stops the drive of a motor 17 by supervising an output signal A and acquiring the falling signal of an output signal A, after driving a motor 17 in the direction of a tele edge. It will be in the state where brush 49a contacted the 1st signal section 56 of the 2nd pattern 52, and the arm 46 contacted tele direction rotation transfer wall 44a in the notching section 44 of a tumbling barrel 15 by this.
[0039] Since it differs by the part of an idling region in the time of carrying out variable power to the time of the lens halt position when carrying out variable power to arbitrary variable power positions with the camera of this operation gestalt carrying out variable power from wide one end from tele one end, When brush 49a contacts the signal section 56 of the 1st pattern 51 or the 2nd pattern 52 in the state of the standby mentioned above, the program mentioned above so that it may be in the state where the arm 46 surely contacted tele direction rotation transfer wall 44a of the notching section 44 is constructed.
[0040] Moreover, with this operation gestalt, since the movement magnitude of a pre-group and the back group lenses 18 and 19 differs the whole variable power position also in the photographic subject distance same at the time of a focus, two or more motor driving pulses corresponding to the lens movement magnitude for every photographic subject distance were prepared for every variable power position, and it has memorized to ROM64. All of these motor driving pulses have a rotation of the area within idling.
[0041] It explains referring to an operation of the above-mentioned composition. The initial state of zoom lens equipment is in the state of the collapsing position shown in drawing 2 , and it is located in the signal section 56 in the rotation position of the cam cylinder 13 for back groups in case brush 49a is a collapsing position. The acted section 91 is exposed inside the notching section 92 of the shutter block 28, and is engaging with the cam side 88 for the maximum opening regulation. Photography is not performed in the period which a zoom lens 10 moves from a collapsing position to a wide position. For this reason, the cam side 88 corresponding to the period serves as a configuration which does not have a variation rate in the hand of cut centering on an optical axis 20.
[0042] A controller 60 drives a motor 17 by rotated part which answers ON of an electric power switch 66 and exceeds an idling region in the direction of a tele edge. This drive is transmitted to a tumbling barrel 15, and a tumbling barrel 17 is that a rotation drive is transmitted, and moves in the direction of an optical axis 20 to the fixed cylinder 16 according to the lead of the helicoid screws 21 and 25. Moreover, the pre-group support cylinder 11 moves in the direction of an optical axis 20 to a tumbling barrel 15 by operation of the rectilinear-propagation guide of the rectilinear-propagation guide cylinder 12 according to the lead of the helicoid screws 26 and 27 because a tumbling barrel 15 rotates. thereby -- the pre-group lens 18 -- composition with the variation rate of a tumbling barrel 15, and the variation rate of the pre-group support cylinder 11 -- it moves in the direction of an optical axis 20 by part for a variation rate
[0043] The rectilinear-propagation guide cylinder 12, the cam cylinder 13 for back groups, and the back group support cylinder 14 move in the direction of an optical axis 20 together with a tumbling barrel 15. And the rotation drive of a tumbling barrel 15 is transmitted to the cam cylinder 13 for back groups because tele direction rotation transfer wall 44a pushes an arm 46 on the hand of cut centering on an optical axis 20. The back group support cylinder 14 is moved in the direction of an optical axis 20 to a tumbling barrel 15 by the variation rate of the cam of the cam opening 38 because the cam cylinder 13 for back groups rotates inside a tumbling barrel 15. Thereby, in addition to the variation rate of a tumbling barrel 15, the back group lens 19 moves in the direction of an optical axis 20 with the variation rate of the cam of the cam opening 38, and the pre-group lens 18 and the interval of a between are changed.

[0044] Rotation of the cam cylinder 13 for back groups slides the sliding child 49 along with the train and the pattern 50 for a ground of the signal section 56 which were prepared in the rectilinear-propagation guide cylinder 12. In the meantime, a controller 60 supervises an output signal B, and when it acquires the falling signal of the output signal B obtained first, it stops the drive of a motor 17. Thereby, the cam cylinder 13 for back groups serves as a rotation position where brush 49a contacted the 1st signal section 56 of the 2nd pattern 52. When a controller 60 acquires the falling signal of the output signal B obtained first, it specifies that a variable power position is a wide edge, and it memorizes this information to RAM65. Thereby, since a variable power position at present is a wide edge even if it detects the variable power operation turned to a wide edge next, a controller 60 can repeal this operation.
[0045] The acted section 91 which constitutes the open opening regulation mechanism 74 in variable power towards a wide position slides along the cam side 88 with the relative variation rate which met in the direction of the optical axis 20 of the pre-group support cylinder 11 and the rectilinear-propagation guide cylinder 12. And when variable power of the zoom lens equipment 10 is carried out to a wide position, engagement to the acted section 91 and the cam side 88 for the maximum opening regulation will be in the state which showed in drawing 7 (A). In addition, in the state in the specific variable power position between a wide edge and a tele edge, and this drawing (C), this drawing (B) shows the state in a tele edge.
[0046] If variable power operation turned at a tele edge after a power supply ON is performed, a controller 60 will perform the program for the tele direction drive. This drives a motor 17 in the direction of a tele edge with the rotation beyond the idling region, and an output signal is supervised during this drive.
[0047] Whenever brush 49a passes the signal section 56 in the rotation position of "Z2, Z3, Z4 [...]", it falls to a controller 60 in order of an output signal A and an output signal B, and starts for it with a signal, and a signal is inputted into it in order. Among these, whenever it acquires one signal, the controller 60 rewrites the information on the variable power position memorized to RAM65. Therefore, the information on a variable power position just before variable power operation is completed is always written in RAM65. Therefore, the completion of variable power operation by the variable power control unit 63 is answered, and a controller 60 reads the information on the variable power position written in RAM65, and judges any of the output signals A and B used as the timing to which the signal section 56 according to the read variable power position stops the drive of a motor 17 by the eventh or the oddth are supervised.
[0048] For example, in [even-numbered] being "Z2", a controller 60 supervises the falling signal of an output signal B, and when it detects the signal, it stops the drive of a motor 17. Thereby, brush 49a will be in the state where the signal section of "Z3" of the 2nd pattern was contacted. The arm 46 is in the state where tele direction rotation transfer wall 44a of the notching section 44 was contacted, at this time.
[0049] When variable power operation is performed in the direction of a wide edge, the wide direction drive program is performed. Compared with the time of this program changing into the state where the arm 46 contacted with tele direction rotation transfer wall 44a at wide direction rotation transfer wall 44b by the side of reverse, and performing variable power operation in the direction of a tele edge in having only reversed the motor 17, gap produces only the part of an idling region in a lens halt position. Therefore, in this direction drive program of a wide edge, the drive of the motor 17 turned in the direction of a wide edge when variable power operation is completed is continued, and when the rotation position of the cam cylinder 13 for back groups turns into a position where brush 49a next passed the signal section 56 corresponding to the variable power position, the drive of a motor 17 is once stopped. Then, a motor 17 is shortly driven with the rotation exceeding an idling region to the position where brush 49a contacts the previous signal section 56 towards the direction of a tele edge conversely. Thereby, whichever it performs variable power in the direction of a wide edge and a tele edge of, the gestalt of the coordinated section turns into a fixed gestalt to which the arm 46 contacted tele direction rotation transfer wall 49a, therefore can make a lens halt position the same.
[0050] Drawing 10 shows the amount of displacement to the direction of the optical axis 20 of the pre-group to the rotation of a motor 17, and the back group lenses 18 and 19. The pre-group lens 18 moves along with the straight line A shown in this drawing by variable power drive, and the back group lens 19 moves along with Curve B. And these lens groups 18 and 19 stop in which position of each variable power position (Z1-Z8). In addition, a variable power position can be set as the arbitrary positions on these variable power tracing without a limit.
[0051] If half-push operation of a shutter release 67 is performed, a controller 60 will operate the photometry mechanism 68 and the ranging mechanism 69. The information on the photographic subject brightness obtained from the photometry mechanism 68 and the ranging mechanism 69 and photographic subject distance is memorized by RAM65. By performing all push operations of a shutter release 67 then, a controller 60 performs a focus drive program. A focus drive program reads an output signal at present, and discriminates whether the signal of a low is acquired from either of the output signals A and B.
[0052] After discernment, when a motor 17 is driven in the direction of a tele edge by rotated part exceeding an idling region and a standup signal is detected to the position which detects the standup signal of the output signals A and B, after driving a motor 17 in this direction by the predetermined pulse, it stops. In the state of standby in a variable power position, since the arm 46 is in contact with tele direction rotation transfer wall 44a, if a motor 17 drives in the direction of a tele edge by focus drive, the drive of a tumbling barrel 15 will be immediately transmitted to the cam cylinder 13 for back groups, brush 49a will rotate together with rotation of the cam cylinder 13 for back groups, and brush 49a will separate from the signal section 56. A drive is stopped, after the signal of a standup is inputted into a controller 60, receiving this and driving a motor 17 in this direction by the fixed pulse, when brush 49a separates. Thereby, brush 49a moves to the position rotated by the predetermined angle in the direction of an arrow shown in drawing 9 from the signal section 56 corresponding to the variable power position at the time. At this time, it will be in the state where tele direction rotation transfer wall 44a contacted the arm 46.
[0053] Then, a controller 60 reads photographic subject distance and reads the motor driving pulse based on the variable power position and photographic subject distance at the time from RAM65. Then, a motor 17 is driven in the direction of a wide edge with the rotation of the area within idling, the pulse acquired from a rotary encoder 62 during this drive is counted, and when in agreement with the value of the motor driving pulse which counted value read, the drive of a motor 17 is stopped. Since the driving pulse of the motor 17 at the time of a focus is the rotation of the area within idling, after focus operation, an arm 46 will be in the state where it

separated from tele direction rotation transfer wall 44a of the notching section. Of course, the arm 46 serves as the state in the state where it was not in contact with direction rotation transfer wall of wide direction 44b, and it shifted in the direction of a neologism first 56 shell tele edge since brush 49a was rotation of the area within idling.
[0054] Since the movement of the zoom lens equipment 10 at the time of a focus is driven in the direction of a tele edge with the rotation to which a motor 17 exceeds an idling region first and it drives in the wide direction with the rotation of the area within idling after that, as shown in drawing 11 When it drives in the direction of a tele edge first, a pre-group and the back group lenses 18 and 19 move to the position shown by the dotted line C through each variable power tracing A and B from the variable power position Zn. Since it rotates in the direction of a wide edge with the rotation of the area within idling after that, the pre-group lens 18 since the back group lens 19 serves as movement only for a variation rate of a tumbling barrel 15 to moving to G1 through the variable power tracing A -- composition with a tumbling barrel 15 and the cam of the cam opening 38 -- the variable power tracing B used as the variation rate -- differing -- the variation rate of a tumbling barrel 15 -- it moves to a point G2 through Tracing D A pre-group and the back group lenses 18 and 19 move at a different interval from the time of variable power by this, and it focuses in the photographic subject distance at the time. Here, a focus is performed towards a focus suiting towards infinity from near. In addition, depending on the method of control, since infinite, it can also consider as operation which doubles the focus towards near.
[0055] An exposure control program is performed after focus drive program execution. By this program, a controller 60 operates a shutter style according to photographic subject brightness and the sensitivity of a photographic film.
[0056] The operation of the shutter style of a controller 60 reads the opening-and-closing time of the shutter wings 71 and 72 according to a variable power position and photographic subject brightness from ROM64, and memorizes it to RAM65. And the energization to the motor 73 for shutters is started. Then, a controller 60 supervises the photoelectrical sensor 96, is receiving the signal of the purport which the shutter wings' 71 and 72 crossed from the photoelectrical sensor 96, and counts time by the counter 97 from the time.
[0057] If opening-and-closing time of the shutter [diameter / which is regulated at a wide edge / of the maximum opening] wings 71 and 72 according to R1, a variable power position, and photographic subject brightness is set to T1 as shown in drawing 12 , the shutter wings 71 and 72 will serve as the diameter R1 of the maximum opening at the time of time T2. At this time, some shutter wings 72 86 contact the regulation pin 90 of the regulation lever 87, and the shutter wings 71 and 72 are regulated by the diameter R1 of the maximum opening.
[0058] When the counted value (time) of a controller 60 in a counter 97 corresponds with the opening-and-closing time T1 of the shutter wing according to a variable power position and photographic subject brightness, it energizes to having mentioned above on the motor 73, and a retrose. Thereby, a motor 73 carries out an inversion drive and the shutter wings 71 and 72 are closed. When this becomes the time T3 to be shown in drawing 12 , the shutter wings 71 and 72 close and it becomes a position, and the area surrounded by the straight line which goes to T3 through each intersection of each of time T2 and T1 and R1 serves as light exposure.
[0059] In addition, when photographic subject brightness is high brightness, as shown in drawing 12 , the shutter wings 71 and 72 may be closed in the time T4 not to reach to the diameter R1 of the maximum opening regulated at a wide edge.
[0060] As shown also in drawing 8 , the diameter of the maximum opening of the shutter wings 71 and 72 which the open aperture regulation mechanism 74 regulates answers that variable power is performed towards the direction of a tele edge from a wide edge, and becomes large gradually. And when variable power exceeds a specific variable power position, the cam side 88 regulates the acted section 91 in the aperture position according to the diameter of the maximum opening.
[0061] In the range from a specific variable power position to a tele edge, the diameter of the maximum opening by which the shutter wings 71 and 72 are regulated serves as an open position of the shutter wings 71 and 72 which all exposes the shutter opening 75. Therefore, if the diameter of the maximum opening regulated at a tele edge is opened and opening-and-closing time of the shutter wings 71 and 72 according to a position, a variable power position, and photographic subject brightness is set to T6, as shown in drawing 12 , the shutter wings 71 and 72 will contact the regulation lever 87 at the time of time T7, and the shutter opening 75 will all be exposed. And when the count time in a counter 97 is set to T6, the shutter wings 71 and 72 rotate in the direction of closing, and when time T8 comes, the shutter wings 71 and 72 close and it becomes a position.
[0062] Thus, since the diameter of the maximum opening of the shutter wings 71 and 72 in the direction of a wide edge becomes small rather than a tele edge, the circumference dotage by the spherical aberration of the taking lenses 18 and 19 which are easy to produce in wide one end can be prevented certainly.
[0063] A controller 60 performs a standby drive program after the completion of exposure. After the completion of exposure, a pre-group and the back group lenses 18 and 19 are having moved to the focus position according to the photographic subject distance at the time with as. Therefore, since it is in the state where brush 49a separated from the signal section 56 according to the variable power position at the time, and the arm 46 separated from tele direction rotation transfer wall 44a, in a standby drive program, control returned to the original variable power position is performed.
[0064] Execution of this program judges whether an output signal A is obtained from the signal section 56 corresponding to the variable power position of the eventh or odd-numbered [namely,] origin in the signal section 56 corresponding to the original variable power position. A controller 60 processes based on the flow which one side of the two flows from which drive control of a motor 17 differs based on this judgment result was chosen, and was chosen.
[0065] A controller 60 drives a motor 17 in the direction of a wide edge by rotated part first exceeding an idling region. It is stopped by this drive, after detecting the standup signal and falling signal of the signal section 56 corresponding to the original variable power position in order and driving by the fixed pulse. Therefore, the cam cylinder 13 for back groups rotates by this drive in the rotation position where brush 49a passed the signal section 56 corresponding to the original variable power position. After that, a controller 60 drives a motor 17 in the direction of a tele edge with the rotation exceeding an idling region until it detects the falling signal from the signal section 56 corresponding to the original variable power position. It will be in the state where brush 49a contacted the signal section 56 corresponding to the original variable power position, and tele direction rotation transfer wall 44a contacted the arm 46 by this.

[0066] After standby drive program execution is completed, film feed is performed and a new photography coma is set to the aperture of a camera. Thereby, preparation of next photography is completed.
[0067] During the standby to which program execution mentioned above is not performed, a standby drive program is performed for every fixed time. If this is performed, first, a controller 60 will read the signal level of the output signal A which may be an execution-time point, or an output signal B, and will judge whether it is the signal of a low. After variable power operation and standby drive program execution, surely, since brush 49a is in the state in contact with the signal section 56, the signal of a low should be acquired from the output signal A or the output signal B. However, when external force, vibration, etc. join a lens-barrel, there is a possibility that the cam cylinder 13 for back groups may race within idling. In this case, when brush 49a was idling of the grade from which it does not separate from the signal section 56, it raced to being satisfactory so that it separated and a focus drive program is performed as it was, there is a possibility of becoming focus dotage. Since a tumbling barrel 15 does not rotate the idling direction of the cam cylinder 13 for back groups, an arm 46 serves as a direction rotated towards wide direction rotation transfer wall 44a. Therefore, brush 49a shifts from the signal section 56 along with the hand of cut to the tele direction of the cam cylinder 13 for back groups.
[0068] For this reason, after driving a motor 17 with the rotation which exceeds an idling region in the direction of a wide edge and passing the signal section 56 corresponding to the original variable power position until it passes the signal section 56 corresponding to the original variable power position when the signal of a low is not acquired from an output signal A or an output signal B, the drive of a motor 17 is stopped after a drive by the predetermined pulse. When a motor 17 is driven with the rotation which exceeds an idling region in the direction of a tele edge after that and the falling signal of the original signal section 56 is acquired, the drive of a motor 17 is stopped. The cam cylinder 13 for back groups can be returned to the rotation position where the arm 46 contacted tele direction rotation transfer wall 44a, and brush 49a contacted the signal section 56 corresponding to the original variable power position by this.
[0069] If an electric power switch 66 is turned off, a controller 60 will drive a motor 17 in the direction of a wide edge with the rotation exceeding an idling region. In the meantime, a controller 60 supervises an output signal Hp. If zoom lens equipment 10 retreats to a collapsing position, brush 49a will contact the pattern 53 for collapsing positions. At this time, an output signal Hp is inputted into a controller 60 through the signal-detection section 55, and when this is received, a controller 60 stops the drive of a motor 17.
[0070] Although considered as 2 group zoom lens in the above-mentioned example, it is applicable not only to this but the zoom lens of two or more groups in this invention. Moreover, although considered as the zoom lens of the two-step protrusion type made to move a pre-group support cylinder and a tumbling barrel in the direction of the photography optical axis 20, it is good also as a zoom lens of the one-step protrusion type to which only a pre-group support cylinder is moved as a cylinder which does not move not only this but a tumbling barrel in the direction of the photography optical axis 20 in this invention.
[0071] Although considered as the cam side which presses the 1st specification-part material to the circumferencial direction centering on a photography optical axis with the above-mentioned operation gestalt, it is good also as a cam side pressed in the direction of a path toward a photography optical axis. In this case, what is necessary is just to make it the cam side which inclined in the direction of an optical axis. Moreover, although the cam member is prepared in the rectilinear-propagation guide cylinder (equivalent to the displacement cylinder of this invention) displaced only in the direction of a photography optical axis to a pre-group support cylinder, in this invention, you may prepare in the cylinder displaced also to the circumferencial direction centering on a photography optical axis, displacing in the cylinder displaced to the salt hoop direction centering on a photography optical axis not only to this but to a pre-group support cylinder, or the direction of a photography optical axis. In this case, what is necessary is to lengthen the notching section to the circumferencial direction centering on an optical axis for a long time, and just to form it in it so that a cam member may rotate among the notching sections according to the variation rate of a cylinder. In this case, it will have the mechanism of the common knowledge to which the 1st specification-part material changes the diameter of the maximum opening of a shutter wing according to the rotation position inside the notching section.
[0072]
[Effect of the Invention] as mentioned above, with the zoom lens equipped with open aperture regulation of this invention The notching section formed in the periphery of a shutter block is made to expose the 1st specification-part material. And since it was made to make a cam member enter the interior of the notching section so that the 1st specification-part material may be pressed in respect of a cam, it is possible to make into the minimum the space between a shutter block and the displacement cylinder arranged at the periphery, and the diameter of a lens barrel can be made compact.

[Translation done.]

* NOTICES *

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2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the decomposition perspective diagram showing the outline of zoom lens equipment.
[Drawing 2] It is the cross section having shown the state of the collapsing position of zoom lens equipment.
[Drawing 3] It is the cross section showing the state of the wide edge of zoom lens equipment.
[Drawing 4] It is the cross section having shown the state of the tele edge of zoom lens equipment.
[Drawing 5] It is explanatory drawing having shown the relation between the notching section and an arm, and the relation between a conductor pattern member and a sliding child, and is looking from the image formation side side.
[Drawing 6] It is explanatory drawing having shown the outline of a zoom lens equipped with open opening regulation of this invention, and is looking from the image formation side side.
[Drawing 7] It is explanatory drawing having shown physical relationship with the regulation lever which is the cam member and the 1st specification-part material which are the 2nd specification-part material for every variable power position, and in (A), the state in a wide edge and (B) show the state in the specific variable power position between a wide edge and a tele edge, and (C) shows the state in a tele edge.
[Drawing 8] It is the graph which showed change of the diameter of the maximum opening in which open opening regulation equipment regulates a shutter style to a variable power position.
[Drawing 9] It is explanatory drawing having shown roughly the relation between a sliding child and a conductor pattern member.
[Drawing 10] It is the graph which showed movement in the direction of an optical axis of the pre-group to the motor rotation at the time of variable power, and a back group lens.
[Drawing 11] It is the graph which showed the movement of the lens at the time of a focus.
[Drawing 12] It is the graph which showed the opening-and-closing time of a shutter wing.
[Description of Notations]
11 Pre-group Support Cylinder
12 Rectilinear-Propagation Guide Cylinder
13 Cam Cylinder for Back Groups
14 Back Group Support Cylinder
15 Tumbling Barrel
16 Fixed Cylinder
17 73 Motor
28 Shutter Block
70 Cam -- Member
88 Cam Side
91 Acted Section

[Translation done.]

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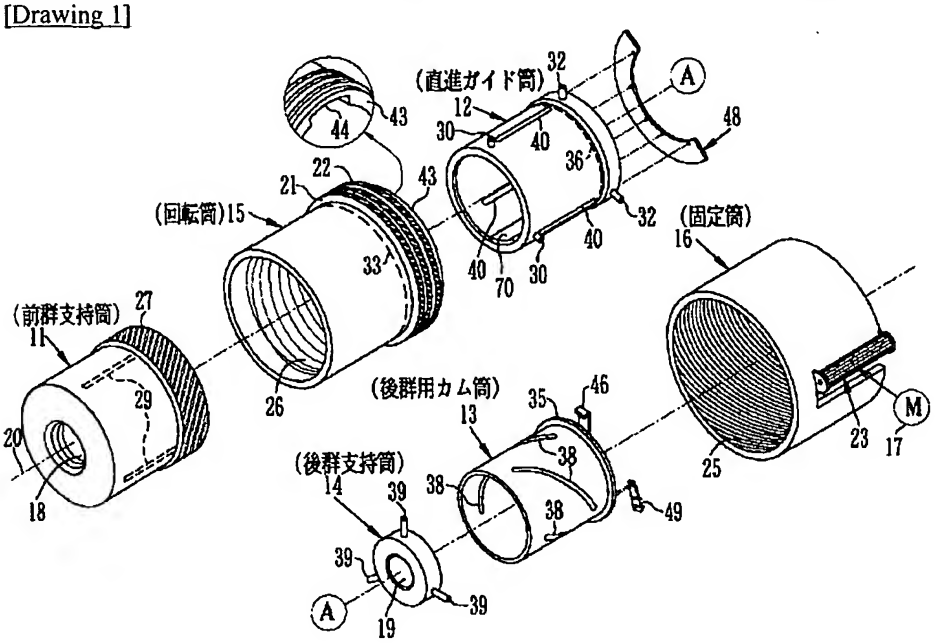
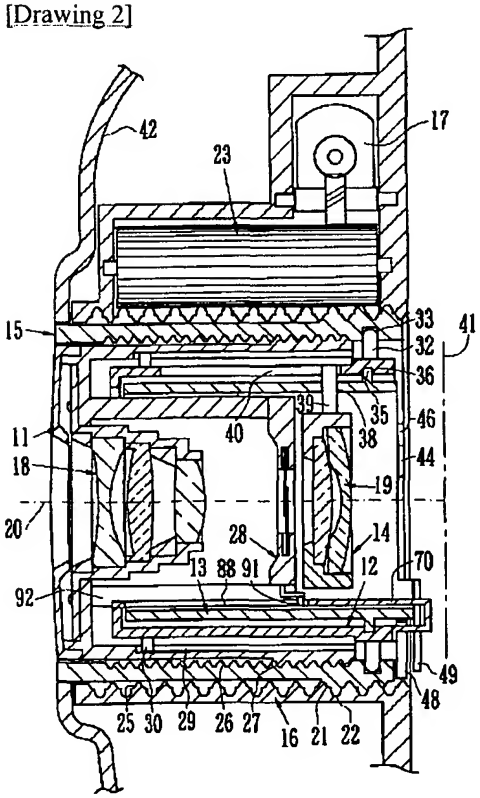
DRAWINGS

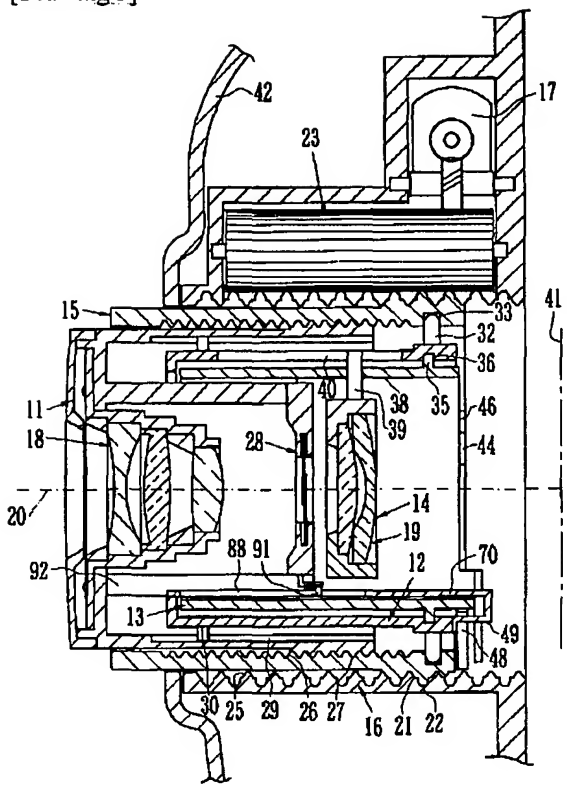
[Drawing 1]



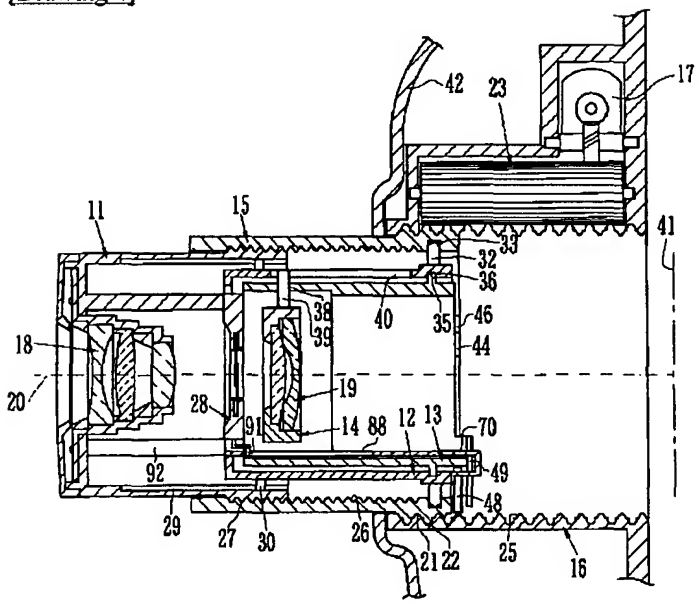
[Drawing 2]



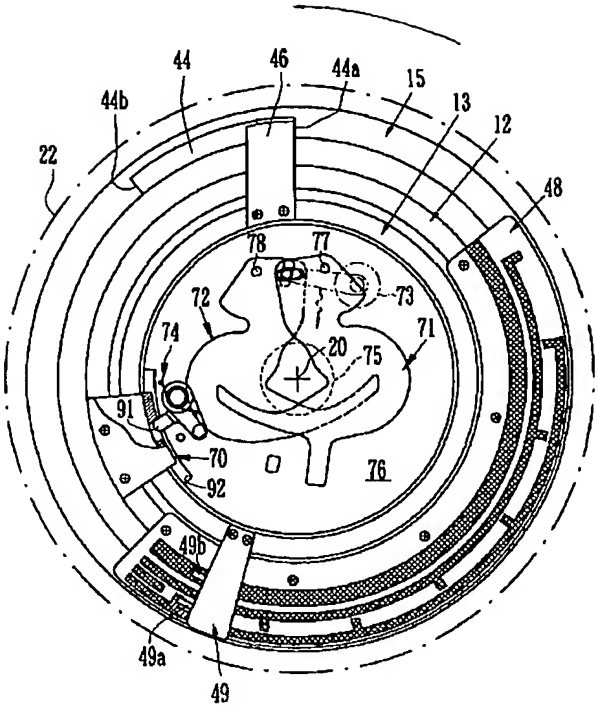
[Drawing 3]



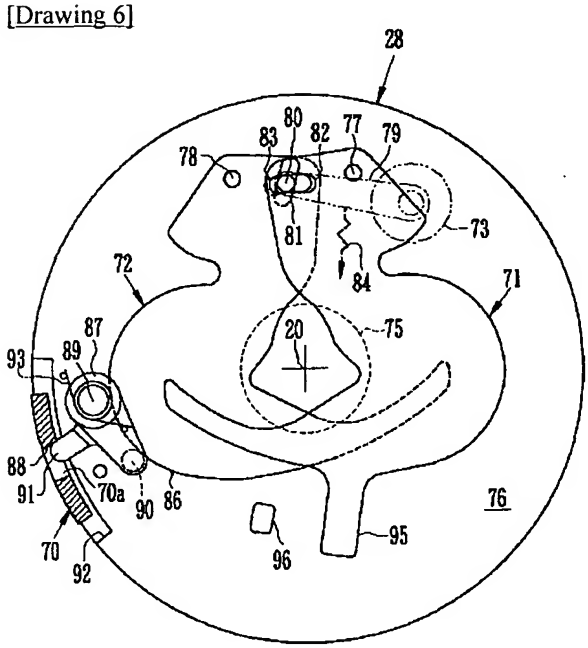
[Drawing 4]



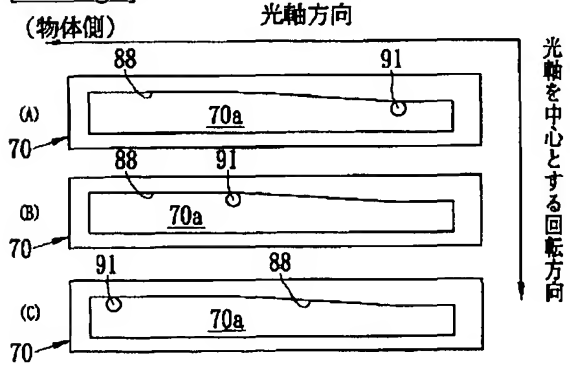
[Drawing 5]



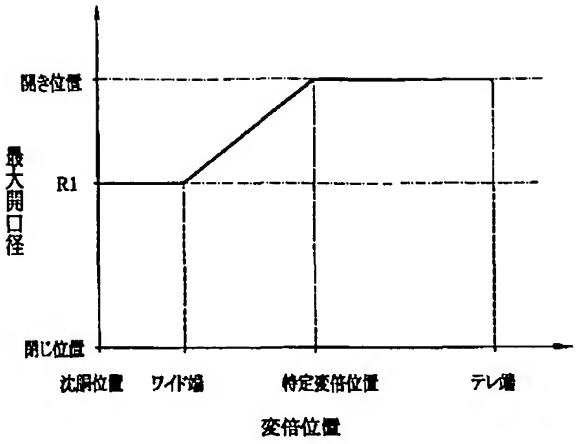
[Drawing 6]



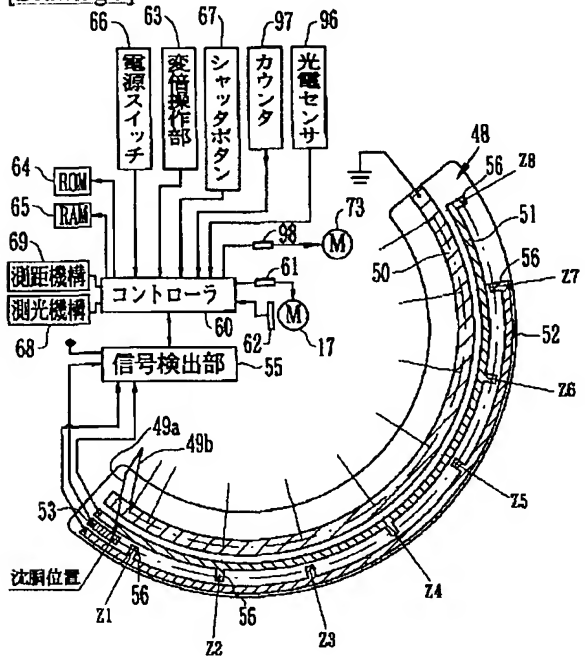
[Drawing 7]



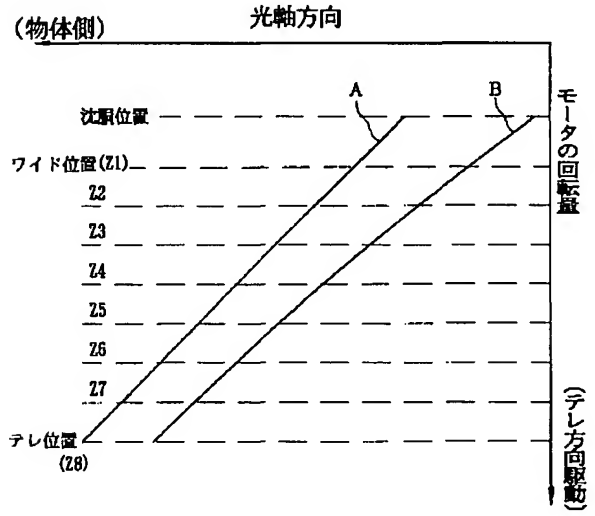
[Drawing 8]



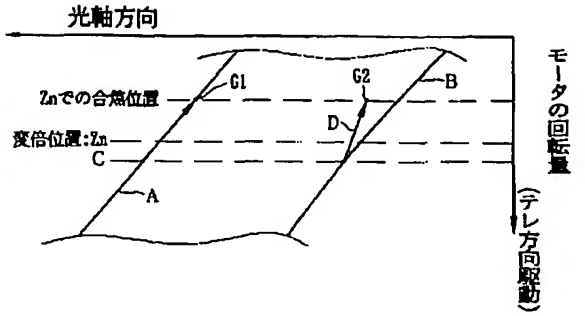
[Drawing 9]



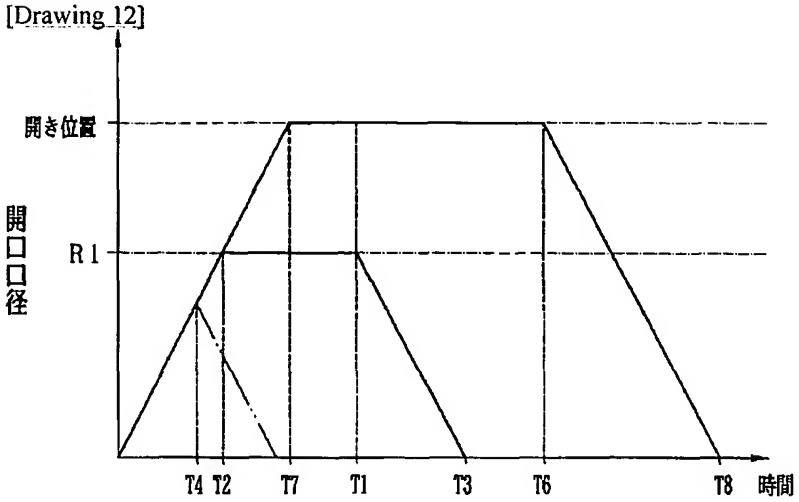
[Drawing 10]



[Drawing 11]



[Drawing 12]



[Translation done.]